VPDES PERMIT FACT SHEET

This document gives pertinent information concerning the reissuance of the Virginia Pollutant Discharge Elimination System (VPDES) permit listed below. This permit is being processed as a Minor, Municipal permit. The effluent limitations contained in this permit will maintain the Water Quality Standards (WQS) of 9VAC25-260. The discharge will result from the operation of a sewage treatment plant serving a campground and recreation area (SIC Code: 7999 - Amusement and Recreation Services). This permit action consists of reissuing the permit with revisions to the permit, as needed, due to changes in applicable laws, guidance, and available technical information.

1. Facility Name and Address:
   Endless Caverns STP
   1800 Endless Caverns Road
   New Market, VA 22844
   Location: 1800 Endless Caverns Road, New Market

2. Permit No. VA0071846; Expiration Date: October 31, 2016

3. Owner: Endless Caverns, LLC
   Contact Name: Edward Belski
   Title: Director of Facilities Engineering
   Telephone No: (518) 369-3815
   Email: ed.belski@gopromegroup.com

4. Description of Treatment Works Treating Domestic Sewage:

   Endless Caverns STP will primarily serve the tourist attractions and campsites at Endless Caverns.

   Average Discharge Flow (July 2009 – June 2011) = 0.0 MGD
   Design Average Flow = 0.039 MGD
   Total Number of Outfalls: 1

5. Application Complete Date: May 4, 2016

   Permit Writer: Keith Showman Date: September 7, 2016
   Reviewed By: Dawn Jeffries Date: September 8, 2016

   Public Comment Period: August XX, 2016 to September XX, 2016

6. Receiving Stream Name: Smith Creek
   River Mile: 17.24
   Use Impairment: Yes (see items 11 and 12 below)
   Special Standards: pH, PWS
   Tidal Waters: No
   Watershed Name: VAV – B47R Smith Creek
   Basin: Potomac; Subbasin: Shenandoah
   Section: 6e; Class: IV

7. Operator License Requirements per 9VAC25-31-200.C: Class II

8. Reliability Class per 9VAC25-790: Class II; within 90 days of notification from DEQ that the town of New Market is/will be using its water intake on Smith Creek, the owner shall submit to DEQ - Valley Regional Office a plan and schedule for upgrading the facility to meet Reliability Class I requirements.

9. Permit Characterization:
   ☑ Private ☐ Federal ☐ State ☐ POTW ☐ PVOTW
   ☐ Possible Interstate Effect ☐ Interim Limits in Other Document (attach copy of CSO)

10. Discharge Location Description and Receiving Waters Information: Appendix A

11. Antidegradation (AD) Review & Comments per 9VAC25-260-30:
    Tier Designation: Tier 1

    The State Water Control Board's WQS include an AD policy. All state surface waters are provided one of three levels of AD protection. For Tier 1 or existing use protection, existing uses of the water body and the water quality to protect these uses must be maintained. Tier 2 waters have water quality that is better than the WQS. Significant lowering of the water quality of Tier 2 waters is not allowed without an evaluation of the economic and social impacts. Tier 3 waters are exceptional waters and are so designated by regulatory amendment. The AD policy prohibits new or expanded discharges into exceptional waters.

    The AD review begins with a Tier determination. Smith Creek in the vicinity of the discharge is determined to be a Tier 1 water. This finding is based on the fact that the stream is currently listed as impaired for not meeting the General Standard (Benthics) for aquatic life use. Antidegradation baselines are not calculated for Tier 1 waters

12. Impaired Use Status Evaluation per 9VAC25-31-220.D: Smith Creek in the vicinity of the discharge is listed as impaired for bacteria and for not meeting the General Standard (Benthics) for aquatic life use. The facility was included in the Sediment and Bacteria TMDL for Smith Creek that was approved by the EPA on June 29, 2004. A Total Daily Maximum Load (TMDL) addressing the bacteria impairment includes the following waste load allocations (WLAs) for this discharge. The WLAs are based on a design flow of 0.0046 MGD.

    E. coli: 8.01×10^9 cfu/yr (based on a concentration of 126 cfu/100 mL)
    TSS 1,641.6 lbs/yr (based on a concentration of 117 mg/L)

13. Site Inspection: Performed by Keith Showman and Danielle Adams on May 25, 2016 and July 12, 2016.

14. Effluent Screening and Effluent Limitations: Appendix B

15. Effluent toxicity testing requirements included per 9VAC25-31-220.D: ☐Yes ☑ No
    This STP has a design flow < 1.0 MGD, has no Significant Industrial Users (SIUs) or Categorical Industrial Users (CIUs), and is not deemed to have the potential to cause or contribute to instream toxicity.

16. Sewage sludge has not been generated at this facility yet; therefore a Sludge Management Plan (SMP) has not been developed at this time. The permit requires that a SMP shall be submitted to DEQ for approval 30 days prior to commencement of discharge from the facility.

17. Bases for Special Conditions: Appendix C

18. Material Storage per 9VAC25-31-280.B.2: This permit requires that the facility's O&M Manual include information to address the management of wastes, fluids, and pollutants which may be present at the facility, to avoid unauthorized discharge of such materials.

19. Antibacksliding Review per 9VAC25-31-220.L: This permit complies with the antibacksliding provisions of the VPDES Permit Regulation.

20. Regulation of Users per 9VAC25-31-280.B.9: N/A – No industrial users are proposed to be contributing to the treatment works.

21. Stormwater Management per 9VAC25-31-120: Application Required? ☐ Yes ☑ No
This STP does not have a design flow > 1.0 MGD, nor is it required to have an approved POTW pretreatment program under 9VAC25-31-10 et seq.

22. Compliance Schedule per 9VAC25-31-250: There are no compliance schedules included in the reissued permit.

23. Variances/Alternative Limits or Conditions per 9VAC25-31-280.B, 100.K, and 100.N: Monitoring data were not submitted for pH, Flow, Temperature, BOD_5, Fecal Coliform, and Total Suspended Solids as part of the permit application as the facility has not yet discharged.

24. Financial Assurance Applicability per 9VAC25-650-10: N/A –This facility does not serve any permanent residences.

25. Virginia Environmental Excellence Program (VEEP) Evaluation per § 10.1-1187.1-7: At the time of this reissuance, is this facility considered by DEQ to be a participant in the Virginia Environmental Excellence Program in good standing at either the Exemplary Environmental Enterprise (E3) level or the Extraordinary Environmental Enterprise (E4) level? ☐ Yes ☑ No

26. Nutrient Trading Regulation per 9VAC25-820: See Appendix B
General Permit Required: ☐ Yes ☑ No
This facility is not required to maintain coverage under the General Virginia Pollutant Discharge Elimination System (VPDES) Watershed Permit Regulation for Total Nitrogen (TN) and Total Phosphorus (TP) Discharges and Nutrient Trading in the Chesapeake Bay Watershed in Virginia ("WGP"; 9VAC25-820) because it is not listed with a WLA in the Registration List in 9VAC25-820-70; nor does the permit authorize expansion to 0.040 MGD or more (or an equivalent industrial load) that is subject to an offset or technology-based requirement; nor is it a new treatment works permitted to discharge > 1,000 gpd and < 40,000 gpd and that commenced discharging on or after January 1, 2011.

27. Nutrient monitoring included per Guidance Memo No. 14-2011: ☐ Yes ☑ No
This facility is a Nonsignificant Discharger (all facilities not classified as Significant Dischargers as defined in the WGP). Effluent sampling for TN and TP has not previously been completed and therefore has been included in the permit.

28. Threatened and Endangered (T&E) Species Screening per 9VAC25-260-20 B.8: Because this is not an issuance or reissuance that allows increased discharge flows, T&E screening is not automatically required. However, in accordance with the VPDES Memorandum of Understanding, T&E screening was coordinated on June 7, 2016 through DCR and June 14, 2016 through DGIF based upon request. Comments were received from DCR on July 6, 2016 and from DGIF August 26, 2016 and are included in the permit processing file. Comments were considered in the drafting of the permit and were also forwarded to the permittee.

29. Public Notice Information per 9VAC25-31-280.B: All pertinent information is on file, and may be inspected and copied by contacting Keith Showman at: DEQ-Valley Regional Office, P.O. Box 3000, Harrisonburg, Virginia 22801, Telephone No. (540) 574-7836, keith.showman@deq.virginia.gov.

Persons may comment in writing or by email to the DEQ on the proposed permit action, and may request a public hearing, during the comment period. Comments shall include the name, address, and telephone number of the writer, and shall contain a complete, concise statement of the factual basis for comments.

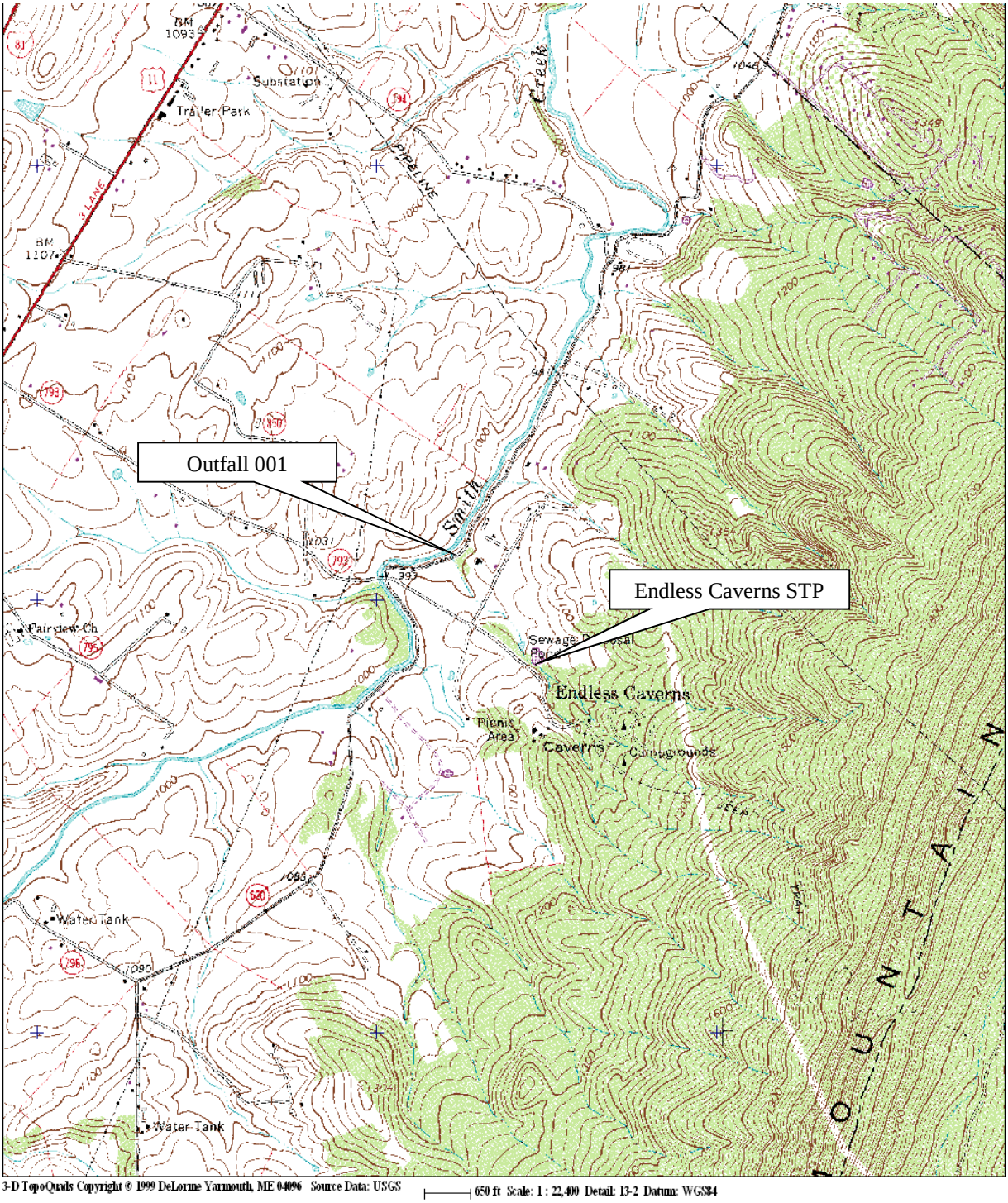
Only those comments received within this period will be considered. The DEQ may decide to hold a public hearing if public response is significant. Requests for public hearings shall state the reason why a hearing is requested, the nature of the issues proposed to be raised in the public hearing and a brief explanation of how the requester's interests would be directly and adversely affected by the proposed permit action. Following the comment period, the Board will make a determination regarding the proposed permit action. This determination will become effective, unless the DEQ grants a public hearing. Due notice of any public hearing will be given.

30. Historical Record: An individual permit (VA0071846) for Endless Caverns to discharge treated domestic wastewater was issued October 25, 1999 and expired October 25, 2004 without renewal. The 1999 permit was tiered at 0.0046 MGD and 0.012 MGD. The treatment facility included a facultative lagoon, post aeration, and chlorination. The facility did discharge under the permit, but it was not renewed because the owners had begun using an on-site system for wastewater treatment in 2004 after a lagoon failure. In 2006, the new owner of the property applied for an individual permit since the intention was to expand the business, and the current on-site system was only capable of handling 2,100 gpd. The permit (VA0071846) was issued November 1, 2006 for a discharge to Smith Creek, UT at a flow of 0.039 MGD. In 2008, the permit was modified to change the outfall location to Smith Creek and include additional flow tiers of 0.010 MGD, 0.020 MGD, and 0.030 MGD. At the time of this reissuance, the 0.039 MGD facility is built but a Certificate to Operate has not been issued and the facility has not been put into operation.

APPENDIX A

DISCHARGE LOCATION AND RECEIVING WATERS INFORMATION

Endless Caverns STP discharges to Smith Creek in Rockingham County. The topographical map below shows the location of the treatment facility and Outfall 001.



PLANNING INFORMATION

Relevant points of interest within the watershed and in the vicinity of the discharge are shown on the Water Quality Assessments Review table below.

WATER QUALITY ASSESSMENTS REVIEW

POTOMAC-SHENANDOAH RIVER BASIN

5/12/2016

IMPAIRED SEGMENTS

SEGMENT ID	STREAM	SEGMENT START	SEGMENT END	SEGMENT LENGTH	PARAMETER
B45R-04-BAC	North Fork Shenandoah River	90.61	56.35	34.26	Fecal Coliform/E-coli
B45R-05-BEN	North Fork Shenandoah River	89.74	76.14	13.6	Benthic
B47R-02-BAC	Mountain Run/Smith Creek/Wal Branch	5.98, 35.00, 6.81	0.00, 0.00, 6.81	5.98, 35.00, 6.81	E-coli
B47R-05-BEN	Smith Creek	25.19	0	25.19	Benthic

PERMITS

PERMIT	FACILITY	STREAM	RIVER MILE	LAT	LONG	WBID
VA0071846	**Endless Caverns LLC**	**Smith Creek**	**17.24**	**383606**	**0784049**	**VAV-B47R**
VA0021342	Virginia Museum of the Civil War STP	N.F. Shenandoah River	79.56	383949	0784028	VAV-B45R
VA0054453	New Market Poultry Products	Smith Creek	12.39	383829	0783940	VAV-B47R
VA0080535	Two Hills Inc. STP	Smith Creek	5.53	384055	0783829	VAV-B47R
VA0089877	New Market Filtration Plant	N.F. Shen River X-Trib	0.95	383857	0784049	VAV-B45R

MONITORING STATIONS

STREAM	NAME	RIVER MILE	RECORD	LAT	LONG
N.F. Shenandoah River	1BNFS076.56	76.56	7/18/68	384126	0783950
N.F. Shenandoah River	1BNFS081.42	81.42	3/3/70	383906	0784154
Smith Creek	1BSMT004.60	4.6	4/23/79	384138	0783836
Smith Creek	1BSMT010.90	10.9	3/3/70	383843	0783842
Smith Creek	1BSMT018.40	18.4	3/3/70	383518	0784207
Smith Creek	1BSMT019.26	19.26	1/22/09	383518	0784207
Smith Creek	1BSMT023.18	23.1	7/1/91	383326	0784356
N.F. Shenandoah River	1BNFS081.61	81.61	6/6/05	383906	0784154
Plains Mill Spring	1BXDX000.48	0.48	5/1/96	383834	0784312
Smith Creek	1BSMT005.71	5.71	5/2/91	384049	0783822
Smith Creek	1BSMT006.62	6.62	5/18/99	384032	0783825
Smith Creek	1BSMT009.08	9.08	6/13/07	383939	0783918

PUBLIC WATER SUPPLY INTAKES

OWNER	STREAM	RIVER MILE
NEW MARKET, TOWN	Smith Creek	13.46

WATER QUALITY MANAGEMENT PLANNING REGULATION

Is this discharge addressed in the WQMP regulation? **No**

If Yes, what effluent limitations or restrictions does the WQMP regulation impose on this discharge?

PARAMETER	ALLOCATION

WATERSHED NAME

VAV-B47R Smith Creek

FLOW FREQUENCY DETERMINATION

The flows in Smith Creek in the vicinity of Endless Caverns STP are influenced by Lacey Spring. Lacey Spring lies upstream of the gage and the STP. The USGS measured the spring flow on several occasions from 2012-2016. The spring flow measurements were compared to the same day daily mean flows measured at the Smith Creek stream flow gage. The percentage of spring flow in Smith Creek was determined for each measurement and an average of the percentages was calculated. The average percent (23%) of spring flow in Smith Creek was then multiplied by the flow frequencies for the gage. The resulting values were considered to represent the flow frequencies for the spring. The values for Smith Creek above the UT were determined by subtracting the flow contributed by Lacey Spring from the flow frequencies for the Smith Creek gage and then performing a drainage area comparison. Once the flow frequencies were determined by the drainage area comparison, the Lacey Spring flows were then added back. The flow frequencies for the gage, Lacey Spring, Smith Creek minus the spring flow, and Smith Creek above the confluence with the Endless Caverns STP discharge are presented below. This analysis does not address any withdraws, discharges, or other springs between the gage and the confluence with the discharge.

Smith Creek near New Market, VA (#01632900):

Drainage Area = 93.6 mi^2

1Q30 =	5.08 cfs	High Flow 1Q10 =	13.7 cfs
1Q10 =	6.83 cfs	High Flow 7Q10 =	15.5 cfs
7Q10 =	7.47 cfs	High Flow 30Q10 =	18.7 cfs
30Q10 =	8.72 cfs	HM =	31.5 cfs
30Q5 =	10.6 cfs		

Refer to Table 1 for the percent of flow contributed to Smith Creek by Lacey Spring. Based on the flow data collected on Lacey Spring, it is estimated that the spring contributes 23% of the flow measured at the Smith Creek gage. Using 23% of the Smith Creek flow frequencies, the flow frequencies for Lacey Spring are:

Lacey Spring at Lacey Spring, VA (#0163285551):

Drainage Area = 0.47 mi^2 (at mouth)

1Q30 =	1.17 cfs	High Flow 1Q10 =	3.15 cfs
1Q10 =	1.57 cfs	High Flow 7Q10 =	3.56 cfs
7Q10 =	1.72 cfs	High Flow 30Q10 =	4.30 cfs
30Q10 =	2.00 cfs	HM =	7.24 cfs
30Q5 =	2.44 cfs		

Smith Creek minus Lacey Spring flow:

Drainage Area = 93.6 mi^2 - 0.47 mi^2 = 93.13 mi^2

1Q30 =	3.91 cfs	High Flow 1Q10 =	10.6 cfs
1Q10 =	5.26 cfs	High Flow 7Q10 =	11.9 cfs
7Q10 =	5.75 cfs	High Flow 30Q10 =	14.4 cfs
30Q10 =	6.72 cfs	HM =	24.3 cfs
30Q5 =	8.16 cfs		

Using a drainage area comparison:

Smith Creek at the discharge point:

Drainage Area = 71.9 mi^2

1Q30 =	3.02 cfs	High Flow 1Q10 =	8.15 cfs
1Q10 =	4.06 cfs	High Flow 7Q10 =	9.22 cfs
7Q10 =	4.44 cfs	High Flow 30Q10 =	11.1 cfs
30Q10 =	5.19 cfs	HM =	18.7 cfs
30Q5 =	6.30 cfs		

Adding back the Lacey Spring flow:

Smith Creek at the discharge point plus Lacey Spring flow:

Drainage Area = 71.9 mi^2

1Q30 =	4.19 cfs	(2.71 MGD)	High Flow 1Q10 =	11.3 cfs	(7.30 MGD)
1Q10 =	5.63 cfs	(3.64 MGD)	High Flow 7Q10 =	12.8 cfs	(8.26 MGD)
7Q10 =	6.16 cfs	(3.98 MGD)	High Flow 30Q10 =	15.4 cfs	(9.96 MGD)
30Q10 =	7.19 cfs	(4.65 MGD)	HM =	26.0 cfs	(16.8 MGD)
30Q5 =	8.74 cfs	(5.65 MGD)			

The high flow months are January through May.

Table 1

Percent of Flow Lacey Spring Contributes to Smith Creek

Date	Lacey Spring flow (cfs)	Smith Creek flow (cfs)	% of flow
7/18/2012	2.67	13	21
11/6/2012	2.55	18	14
1/29/2013	5.68	28	20
5/1/2013	10.2	49	21
5/28/2014	21.1	92	23
10/8/2014	5.36	15	36
3/18/2015	11.6	117	10
6/10/2015	12	32	38
3/3/2016	19.3	141	14
		Average =	23

EFFLUENT/STREAM MIXING EVALUATION

Mixing zone predictions were made with the Virginia DEQ Mixing Zone Analysis Version 2.1 program. The predictions are based on the discharge and receiving stream characteristics, and are presented below.

0.010 MGD Annual Mix	**0.020 MGD Annual Mix**
Effluent Flow = 0.010 MGD Stream 7Q10 = 3.98 MGD Stream 30Q10 = 4.65 MGD Stream 1Q10 = 3.64 MGD Stream slope = 0.0019 ft/ft Stream width = 15 ft Bottom scale = 2 Channel scale = 1 --- Mixing Zone Predictions @ 7Q10 Depth = .6891 ft Length = 379.99 ft Velocity = .5974 ft/sec Residence Time = .0074 days Recommendation: A complete mix assumption is appropriate for this situation and the entire 7Q10 may be used. --- Mixing Zone Predictions @ 30Q10 Depth = .7585 ft Length = 348.96 ft Velocity = .6335 ft/sec Residence Time = .0064 days Recommendation: A complete mix assumption is appropriate for this situation and the entire 30Q10 may be used. --- Mixing Zone Predictions @ 1Q10 Depth = .6522 ft Length = 399.01 ft Velocity = .5775 ft/sec Residence Time = .1919 hours Recommendation: A complete mix assumption is appropriate for this situation and the entire 1Q10 may be used.	Effluent Flow = 0.020 MGD Stream 7Q10 = 3.98 MGD Stream 30Q10 = 4.65 MGD Stream 1Q10 = 3.64 MGD Stream slope = 0.0019 ft/ft Stream width = 15 ft Bottom scale = 2 Channel scale = 1 --- Mixing Zone Predictions @ 7Q10 Depth = .6903 ft Length = 379.36 ft Velocity = .598 ft/sec Residence Time = .0073 days Recommendation: A complete mix assumption is appropriate for this situation and the entire 7Q10 may be used. --- Mixing Zone Predictions @ 30Q10 Depth = .7601 ft Length = 348.16 ft Velocity = .634 ft/sec Residence Time = .0064 days Recommendation: A complete mix assumption is appropriate for this situation and the entire 30Q10 may be used. --- Mixing Zone Predictions @ 1Q10 Depth = .6533 ft Length = 398.38 ft Velocity = .5781 ft/sec Residence Time = .1914 hours Recommendation: A complete mix assumption is appropriate for this situation and the entire 1Q10 may be used.
0.030 MGD Annual Mix	**0.039 MGD Annual Mix**
Effluent Flow = 0.030 MGD Stream 7Q10 = 3.98 MGD Stream 30Q10 = 4.65 MGD Stream 1Q10 = 3.64 MGD Stream slope = 0.0019 ft/ft Stream width = 15 ft Bottom scale = 2 Channel scale = 1 --- Mixing Zone Predictions @ 7Q10 Depth = .6914 ft Length = 378.83 ft Velocity = .5985 ft/sec Residence Time = .0073 days Recommendation: A complete mix assumption is appropriate for this situation and the entire 7Q10 may be used. --- Mixing Zone Predictions @ 30Q10 Depth = .761 ft Length = 347.8 ft Velocity = .6346 ft/sec Residence Time = .0063 days Recommendation: A complete mix assumption is appropriate for this situation and the entire 30Q10 may be used. --- Mixing Zone Predictions @ 1Q10 Depth = .6541 ft Length = 398.06 ft Velocity = .5788 ft/sec Residence Time = .191 hours Recommendation: A complete mix assumption is appropriate for this situation and the entire 1Q10 may be used.	Effluent Flow = 0.039 MGD Stream 7Q10 = 3.98 MGD Stream 30Q10 = 4.65 MGD Stream 1Q10 = 3.64 MGD Stream slope = 0.0019 ft/ft Stream width = 15 ft Bottom scale = 2 Channel scale = 1 --- Mixing Zone Predictions @ 7Q10 Depth = .6923 ft Length = 378.39 ft Velocity = .5991 ft/sec Residence Time = .0073 days Recommendation: A complete mix assumption is appropriate for this situation and the entire 7Q10 may be used. --- Mixing Zone Predictions @ 30Q10 Depth = .762 ft Length = 347.34 ft Velocity = .635 ft/sec Residence Time = .0063 days Recommendation: A complete mix assumption is appropriate for this situation and the entire 30Q10 may be used. --- Mixing Zone Predictions @ 1Q10 Depth = .6554 ft Length = 397.28 ft Velocity = .5793 ft/sec Residence Time = .1905 hours Recommendation: A complete mix assumption is appropriate for this situation and the entire 1Q10 may be used.

APPENDIX B

EFFLUENT SCREENING AND EFFLUENT LIMITATIONS

EFFLUENT LIMITATIONS

A comparison of technology and water quality-based limits was performed and the most stringent limits were selected, as summarized in the table below.

Outfall 001 **Final Limits** **Flow Tier: 0.010 MGD**

PARAMETER	BASIS FOR LIMITS	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
		Monthly Average		Maximum		Frequency	Sample Type
Flow (MGD)	1	NL		NL		1/Day	Estimate
---	---	Monthly Average		Weekly Average		---	---
BOD_5	2,3,4	30 mg/L	1.1 kg/d	45 mg/L	1.7 kg/d	1/Month	Grab
TSS	2	30 mg/L	1.1 kg/d	45 mg/L	1.7 kg/d	1/Month	Grab
Effluent Chlorine (TRC)(mg/L)*	3,5	2.0		2.4		1/Day	Grab
E. coli (N/100 mL) (geometric mean)	7	57		NA		4/Month 10 am to 4 pm	Grab
---	---	Minimum		Maximum		---	---
pH (S.U.)	3	6.5		9.5		1/Day	Grab
Dissolved Oxygen (mg/L)	4,5	5.0		NA		1/Day	Grab
Contact Chlorine (TRC)(mg/L)*	3,5	1.5		NA		1/Day	Grab
TKN (mg/L)	6	NA		NL		1/Year	Grab
Nitrite-N + Nitrate-N (mg/L)	6	NA		NL		1/Year	Grab
Total Nitrogen (mg/L)	6	NA		NL		1/Year	Calculated
Total Phosphorus (mg/L)	6	NA		NL		1/Year	Grab

Refer to permit for definitions of monitoring frequencies and sample types
** Applicable only when chlorination is used for disinfection*

BASIS DESCRIPTIONS

1. *VPDES Permit Regulation (9VAC25-31)*
2. *Federal Effluent Requirements (Secondary Treatment Regulation - 40CFR133)*
3. *Water Quality Standards (9VAC25-260)*
4. *Regional Stream Model (v.4.11)*
5. *Professional Judgment (PJ)*
6. *Guidance Memo No. 14-2011*
7. *Smith Creek TMDL*

Outfall 001 **Final Limits** **Flow Tier: 0.020 MGD**

PARAMETER	BASIS FOR LIMITS	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
		Monthly Average		Maximum		Frequency	Sample Type
Flow (MGD)	1	NL		NL		1/Day	Estimate
---	---	Monthly Average		Weekly Avg.		---	---
BOD_5	2,3,4	30 mg/L	2.3 kg/d	45 mg/L	3.4 kg/d	1/Month	Grab
TSS	7	26 mg/L	2.0 kg/d	40 mg/L	3.1 kg/d	1/Month	Grab
Effluent Chlorine (TRC)(mg/L)*	3	1.6		2.0		1/Day	Grab
E. coli (N/100 mL) (geometric mean)	7	28		NA		4/Month 10 am to 4 pm	Grab
---	---	Minimum		Maximum		---	---
pH (S.U.)	3	6.5		9.5		1/Day	Grab
Dissolved Oxygen (mg/L)	4,5	5.0		NA		1/Day	Grab
Contact Chlorine (TRC)(mg/L)*	3,5	1.5		NA		1/Day	Grab
TKN (mg/L)	6	NA		NL		1/Year	Grab
Nitrite-N + Nitrate-N (mg/L)	6	NA		NL		1/Year	Grab
Total Nitrogen (mg/L)	6	NA		NL		1/Year	Calculated
Total Phosphorus (mg/L)	6	NA		NL		1/Year	Grab

Refer to permit for definitions of monitoring frequencies and sample types
** Applicable only when chlorination is used for disinfection*

BASIS DESCRIPTIONS

1. *VPDES Permit Regulation (9VAC25-31)*
2. *Federal Effluent Requirements (Secondary Treatment Regulation - 40CFR133)*
3. *Water Quality Standards (9VAC25-260)*
4. *Regional Stream Model (v.4.11)*
5. *Professional Judgment (PJ)*
6. *Guidance Memo No. 14-2011*
7. *Smith Creek TMDL*

Outfall 001 **Final Limits** **Flow Tier: 0.030 MGD**

PARAMETER	BASIS FOR LIMITS	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
		Monthly Average		Maximum		Frequency	Sample Type
Flow (MGD)	1	NL		NL		Continuous	Estimate
---	---	Monthly Average		Weekly Avg.		---	---
BOD_5	2,3,4	30 mg/L	3.4 kg/d	45 mg/L	5.1 kg/d	1/Month	Grab
TSS	7	17 mg/L	2.0 kg/d	27 mg/L	3.1 kg/d	1/Month	Grab
Effluent Chlorine (TRC)(mg/L)*	3	1.1		1.3		1/Day	Grab
E. coli (N/100 mL) (geometric mean)	7	19		NA		4/Month 10 am to 4 pm	Grab
---	---	Minimum		Maximum		---	---
pH (S.U.)	3	6.5		9.5		1/Day	Grab
Dissolved Oxygen (mg/L)	4,5	5.0		NA		1/Day	Grab
Contact Chlorine (TRC)(mg/L)*	3,5	1.5		NA		1/Day	Grab
TKN (mg/L)	6	NA		NL		1/Year	Grab
Nitrite-N + Nitrate-N (mg/L)	6	NA		NL		1/Year	Grab
Total Nitrogen (mg/L)	6	NA		NL		1/Year	Calculated
Total Phosphorus (mg/L)	6	NA		NL		1/Year	Grab

Refer to permit for definitions of monitoring frequencies and sample types
** Applicable only when chlorination is used for disinfection*

BASIS DESCRIPTIONS

1. *VPDES Permit Regulation (9VAC25-31)*
2. *Federal Effluent Requirements (Secondary Treatment Regulation - 40CFR133)*
3. *Water Quality Standards (9VAC25-260)*
4. *Regional Stream Model (v.4.11)*
5. *Professional Judgment (PJ)*
6. *Guidance Memo No. 14-2011*
7. *Smith Creek TMDL*

Outfall 001 **Final Limits** **Design Flow: 0.039 MGD**

PARAMETER	BASIS FOR LIMITS	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
		Monthly Average		Maximum		Frequency	Sample Type
Flow (MGD)	1	NL		NL		1/Day	Estimate
---	---	Monthly Average		Weekly Avg.		---	---
BOD_5	2,3,4	30 mg/L	4.4 kg/d	45 mg/L	6.6 kg/d	1/Month	Grab
TSS	7	13 mg/L	2.0 kg/d	21 mg/L	3.1 kg/d	1/Month	Grab
Effluent Chlorine (TRC)(mg/L)*	3	0.80		0.98		1/Day	Grab
E. coli (N/100 mL) (geometric mean)	7	14		NA		4/Month 10 am to 4 pm	Grab
---	---	Minimum		Maximum		---	---
pH (S.U.)	3	6.5		9.5		1/Day	Grab
Dissolved Oxygen (mg/L)	4,5	5.0		NA		1/Day	Grab
Contact Chlorine (TRC)(mg/L)*	3,5	1.5		NA		1/Day	Grab
TKN (mg/L)	6	NA		NL		1/Year	Grab
Nitrite-N + Nitrate-N (mg/L)	6	NA		NL		1/Year	Grab
Total Nitrogen (mg/L)	6	NA		NL		1/Year	Calculated
Total Phosphorus (mg/L)	6	NA		NL		1/Year	Grab

Refer to permit for definitions of monitoring frequencies and sample types
** Applicable only when chlorination is used for disinfection*

BASIS DESCRIPTIONS

1. *VPDES Permit Regulation (9VAC25-31)*
2. *Federal Effluent Requirements (Secondary Treatment Regulation - 40CFR133)*
3. *Water Quality Standards (9VAC25-260)*
4. *Regional Stream Model (v.4.11)*
5. *Professional Judgment (PJ)*
6. *Guidance Memo No. 14-2011*
7. *Smith Creek TMDL*

LIMITING FACTORS – OVERVIEW:
The following potential limiting factors have been considered in developing this permit and fact sheet:

Water Quality Management Plan Regulation (WQMP) (9VAC25-720)	
A. TMDL limits	**TSS, E. coli**
B. Non-TMDL WLAs	**None**
C. CBP (TN & TP) WLAs	**Not applicable**
Federal Effluent Guidelines	**BOD_5, TSS, pH**
PJ/Agency Guidance limits	**DO, TRC (contact), TN, TP, Nitrite-N + Nitrate-N, TKN**
Water Quality-based Limits - numeric	**BOD_5, DO, TRC (effluent), E. coli, pH, Ammonia-N**
Water Quality-based Limits - narrative	**None**
Technology-based Limits (9VAC25-40-70)	**Not applicable**
Whole Effluent Toxicity (WET)	**Not applicable**
Storm Water Limits	**Not applicable**

EVALUATION OF THE EFFLUENT – CONVENTIONAL POLLUTANTS:
The discharge was previously modeled during the 2011 reissuance. There is no new effluent or stream information available that would indicate that the previous model is not protective of WQS; therefore, the previous model has been carried forward during this reissuance. The modeling information is maintained in the DEQ-VRO receiving stream DO model files. The following values were demonstrated to protective at the 0.039 MGD flow tier. Because these limits are protective at the 0.039 MGD flow tier, they are also protective at the lower flow tiers.

$CBOD_5$ = 25 mg/L
TKN = 20 mg/L
DO = 5mg/L

Because a $CBOD_5$ concentration of 25 mg/L is equivalent to a BOD_5 concentration of 30 mg/L, a BOD_5 permit limit of 30 mg/L has been carried forward from the previous permit for all the flow tiers.

Based on the model, it was determined that no TKN limits were needed because a sewage treatment plant is not expected to discharge effluent with TKN concentrations greater than 20 mg/L.

Endless Caverns STP was assigned a TSS WLA of 1,641.6 lbs/yr in the Smith Creek TMDL. The WLA is based on a TSS concentration of 117 mg/L and a design flow of 0.0046 MGD. The WLA was converted to a loading of 2.04 kg/d and expressed in the permit as a monthly average loading limit 2.0 kg/d and weekly average load limit of 3.1 kg/d. Using these load allocations, concentrations for each flow were calculated as shown below. Values were expressed in the permit by rounding down to two significant figures in order to meet the load allocation and meet agency guidance on significant figures. Where concentration averages determined by the TMDL WLAs are greater than secondary limits required by federal regulation, secondary limits are imposed in the permit.

Flow	Monthly Average	Weekly Average
0.010 MGD	52.8 mg/L	81.9 mg/L
0.020 MGD	26.4 mg/L	40.9 mg/L
0.030 MGD	17.6 mg/L	27.3 mg/L
0.039 MGD	13.5 mg/L	21.0 mg/L

A DO minimum limit of 5.0 mg/L has been included for all flow tiers based on PJ and has been carried forward from the previous permit.

The pH limits reflect the current WQS for pH in the receiving stream and have been carried forward from the previous permit.

EVALUATION OF THE EFFLUENT – DISINFECTION:

The E. coli limits have been carried forward from the previous permit. The Smith Creek TMDL assigned an E. coli WLA of 8.09×10^9 cfu/year to this facility based on a design flow of 0.0046 MGD and an E. coli concentration of 126 N/100 mL. The WLA was converted to concentrations for each flow tier as shown below and expressed in the permit as a geometric mean by rounding down to two significant figures in order to meet the load allocation and meet agency guidance on significant figures.

Flow	Monthly Geometric Mean
0.010 MGD	57.9 N/100 mL
0.020 MGD	28.9 N/100 mL
0.030 MGD	19.3 N/100 mL
0.039 MGD	14.9 N/100 mL

Should the facility need to utilize chlorine disinfection:

- Effluent and "Contact" chlorine monitoring and limits are specified in the permit. Due to the PWS designation for the receiving stream, the minimum chlorine level after the contact tank is 1.5 mg/L rather than 1.0 mg/L.
- Due to the bacteria limits being below WQS, monitoring for E.coli is 4/Month regardless of the type of disinfection used.

EVALUATION OF THE EFFLUENT – NUTRIENTS:

In accordance with § 62.1-44.19:14.C.5 of the Code of Virginia, TN and TP baselines are being established for this facility to represent nutrient discharge allowances as of July 1, 2005. These baselines will be used as a limiting factor should the facility ever expand to a design flow of 0.040 MGD or greater. For municipal facilities, the baselines are based on the permitted design capacity of the facility. The permitted design capacity is defined as

Total N or P (lb/yr) = concentration (mg/L) x design flow (MGD) x 8.345 x 365 (days/yr)
where:

Design flow – as of July 1, 2005, the approved flow was 0.012 MGD
Concentration – the treatment provided as of July 1, 2005 was TN = 18.7 mg/L and TP = 2.5 mg/L (assumed concentrations based on secondary treatment facility)

TN = 18.7 mg/l x 0.012 MGD x 8.345 x 365 days/yr = 684 lb/yr
TP = 2.5 mg/l x 0.012 MGD x 8.345 x 365 days/yr = 91 lb/yr

The "permitted design capacity" or "permitted capacity" in terms of annual mass load of total nitrogen or total phosphorus discharged by this non-significant discharger is assumed to be that achieved at the current design flow using the currently installed technology.

Nonsignificant dischargers are subject to aggregate wasteload allocations for TN, TP, and Sediment under the TMDL for the Chesapeake Bay. In accordance with Guidance Memo No. 14-2011, monitoring of TN and TP is required for this permit term in order to verify the aggregate WLAs.

EVALUATION OF THE EFFLUENT – TOXICS:

Stream: Water quality data for the receiving stream were obtained from Ambient Monitoring Station No. 1BSMT023.18 on Smith Creek. A Flow Frequency Determination for the receiving stream is included in Appendix A. The "Wet Season" or "High Flow" months are January through May.

Stream Information			
90% Annual Temp (°C) =	18.9	90% pH (SU) =	8.2
90% Wet Temp (°C) =	14.8	10% pH (SU) =	7.6
Mean Hardness (mg/L) =	230		

Discharge: Because this facility has not discharged there is no effluent data. The effluent values shown were utilized per PJ and have been carried forward from the previous fact sheet.

Effluent Information			
90% Annual Temp (°C) =	25	90% pH (SU) =	7.5
90% Wet Temp (°C) =	15	10% pH (SU) =	7.0
Mean Hardness (mg/L) =	150		

WQC and WLAs were calculated for the WQS parameters for which data are available. The resulting WQC and WLAs are presented in this appendix. Current agency guidelines recommends the evaluation of toxic pollutant limits for TRC and Ammonia-N be based on default effluent concentrations of 20 mg/L and 9 mg/L, respectively. The effluent data were analyzed per the protocol for evaluation of effluent toxic pollutants included in this appendix with the following results:

- Ammonia-N: No limits were determined to be necessary for Ammonia-N at the 0.039 MGD design flow. Because no limits were determined to be necessary at the 0.039 MDG design flow, no limits were necessary at the lower flow tiers.

- TRC: Limits identical to those in the previous permit were determined to be necessary for the flow tiers 0.01 and 0.039 MGD. Less stringent limits were determined to be necessary for the flow tiers 0.02 and 0.03 MGD. The less stringent TRC limits comply with the Antibacksliding provisions of the VPDES Permit Regulation because new stream flow information is available which would have justified the less stringent limits when the previous limits were established. WLAs were calculated but were not used to determine the limits for the 0.010 MGD flow tier because they were greater than 4 mg/L. Per Guidance Memo No. 00-2011, if an acute WLA greater than 4 mg/L is calculated, then 4 mg/L is used for both acute and chronic WLAs when determining effluent limits.

WQC-WLA SPREADSHEET INPUT – 0.01 MGD

WATER QUALITY CRITERIA / WASTE LOAD ALLOCATION ANALYSIS

Facility Name: Endless Caverns STP
Receiving Stream: Smith Creek
Permit No.: VA00071846
Date: 7/21/2016
Version: OWP Guidance Memo 00-2011 (8/24/00)

Stream Information		Stream Flows		Mixing Information			Effluent Information	
Mean Hardness (as CaCO3) =	230 mg/L	1Q10 (Annual) =	3.64 MGD	Annual	- 1Q10 Flow =	100 %	Mean Hardness (as CaCO3) =	150 mg/L
90% Temperature (Annual) =	18.9 deg C	7Q10 (Annual) =	3.98 MGD		- 7Q10 Flow =	100 %	90% Temp (Annual) =	25 deg C
90% Temperature (Wet season) =	14.8 deg C	30Q10 (Annual) =	4.65 MGD		- 30Q10 Flow =	100 %	90% Temp (Wet season) =	15 deg C
90% Maximum pH =	8.2 SU	1Q10 (Wet season) =	7.3 MGD	Wet Season	- 1Q10 Flow =	%	90% Maximum pH =	7.5 SU
10% Maximum pH =	7.6 SU	30Q10 (Wet season) =	9.96 MGD		- 30Q10 Flow =	%	10% Maximum pH =	7.0 SU
Tier Designation =	1	30Q5 =	5.65 MGD				Current Discharge Flow =	0.00000 MGD
Public Water Supply (PWS) Y/N? =	Y	Harmonic Mean =	16.8 MGD				Discharge Flow for Limit Analysis =	0.01 MGD
V(alley) or P(iedmont)? =	V							
Trout Present Y/N? =	N							
Early Life Stages Present Y/N? =	Y							

Footnotes:

1. All concentrations expressed as micrograms/liter (ug/l), unless noted otherwise.
2. All flow values are expressed as Million Gallons per Day (MGD).
3. Discharge volumes are highest monthly average or 2C maximum for Industries and design flows for Municipals.
4. Hardness expressed as mg/l CaCO3. Standards calculated using Hardness values in the range of 25-400 mg/l CaCO3.
5. "Public Water Supply" protects for fish & water consumption. "Other Surface Waters" protects for fish consumption only.
6. Carcinogen "Y" indicates carcinogenic parameter.
7. Ammonia WQSs selected from separate tables, based on pH and temperature.
8. Metals measured as Dissolved, unless specified otherwise.
9. WLA = Waste Load Allocation (based on standards).
10. WLA = Waste Load Allocation (based on standards).
11. WLAs are based on mass balances (less background, if data exist).
12. Acute - 1 hour avg. concentration not to be exceeded more than 1/3 years.
13. Chronic - 4 day avg. concentration (30 day avg. for Ammonia) not to be exceeded more than 1/3 years.
14. Mass balances employ 1Q10 for Acute, 30Q10 for Chronic Ammonia, 7Q10 for Other Chronic, 30Q5 for Non-carcinogens, and Harmonic Mean for Carcinogens. Actual flows employed are a function of the mixing analysis and may be less than the actual flows.
15. Effluent Limitations are calculated elsewhere using the minimum WLA and EPA's statistical approach (Technical Support Document).

WQC-WLA SPREADSHEET OUTPUT – 0.01 MGD

Facility Name: Endless Caverns STP
Permit No.: VA00071846
Receiving Stream: Smith Creek
Date: 7/21/2016

POST - DISCHARGE WATER QUALITY CRITERIA
0.010 MGD Discharge Flow - Mix per "Mixer"

NON-ANTIDEGRADATION WASTE LOAD ALLOCATIONS
0.010 MGD Discharge - Mix per "Mixer"

Toxic Parameter and Form	Carcinogen?	Aquatic Protection Acute	Aquatic Protection Chronic	Human Health Public Water Supplies	Human Health Other Surface Waters	Aquatic Protection Acute	Aquatic Protection Chronic	Human Health
Ammonia-N (Annual)	N	5.8E+00 mg/L	1.4E+00 mg/L	None	None	2.1E+03 mg/L	6.3E+02 mg/L	N/A
Chlorine, Total Residual	N	1.9E-02 mg/L	1.1E-02 mg/L	None	None	6.9E+00 mg/L	4.4E+00 mg/L	N/A

WQC-WLA SPREADSHEET INPUT – 0.02 MGD

WATER QUALITY CRITERIA / WASTE LOAD ALLOCATION ANALYSIS

Facility Name: Endless Caverns STP
Receiving Stream: Smith Creek
Permit No.: VA00071846
Date: 7/21/2016
Version: OWP Guidance Memo 00-2011 (8/24/00)

Stream Information		Stream Flows		Mixing Information			Effluent Information	
Mean Hardness (as CaCO3) =	230 mg/L	1Q10 (Annual) =	3.64 MGD	Annual	- 1Q10 Flow =	100 %	Mean Hardness (as CaCO3) =	150 mg/L
90% Temperature (Annual) =	18.9 deg C	7Q10 (Annual) =	3.98 MGD		- 7Q10 Flow =	100 %	90% Temp (Annual) =	25 deg C
90% Temperature (Wet season) =	14.8 deg C	30Q10 (Annual) =	4.65 MGD		- 30Q10 Flow =	100 %	90% Temp (Wet season) =	15 deg C
90% Maximum pH =	8.2 SU	1Q10 (Wet season) =	7.3 MGD	Wet Season	- 1Q10 Flow =	%	90% Maximum pH =	7.5 SU
10% Maximum pH =	7.6 SU	30Q10 (Wet season) =	9.96 MGD		- 30Q10 Flow =	%	10% Maximum pH =	7.0 SU
Tier Designation =	1	30Q5 =	5.65 MGD				Current Discharge Flow =	0.00000 MGD
Public Water Supply (PWS) Y/N? =	Y	Harmonic Mean =	16.8 MGD				Discharge Flow for Limit Analysis =	0.02 MGD
V(alley) or P(iedmont)? =	V							
Trout Present Y/N? =	N							
Early Life Stages Present Y/N? =	Y							

Footnotes:

1. All concentrations expressed as micrograms/liter (ug/l), unless noted otherwise.
2. All flow values are expressed as Million Gallons per Day (MGD).
3. Discharge volumes are highest monthly average or 2C maximum for Industries and design flows for Municipals.
4. Hardness expressed as mg/l CaCO3. Standards calculated using Hardness values in the range of 25-400 mg/l CaCO3.
5. "Public Water Supply" protects for fish & water consumption. "Other Surface Waters" protects for fish consumption only.
6. Carcinogen "Y" indicates carcinogenic parameter.
7. Ammonia WQSs selected from separate tables, based on pH and temperature.
8. Metals measured as Dissolved, unless specified otherwise.
9. WLA = Waste Load Allocation (based on standards).
10. WLA = Waste Load Allocation (based on standards).
11. WLAs are based on mass balances (less background, if data exist).
12. Acute - 1 hour avg. concentration not to be exceeded more than 1/3 years.
13. Chronic - 4 day avg. concentration (30 day avg. for Ammonia) not to be exceeded more than 1/3 years.
14. Mass balances employ 1Q10 for Acute, 30Q10 for Chronic Ammonia, 7Q10 for Other Chronic, 30Q5 for Non-carcinogens, and Harmonic Mean for Carcinogens. Actual flows employed are a function of the mixing analysis and may be less than the actual flows.
15. Effluent Limitations are calculated elsewhere using the minimum WLA and EPA's statistical approach (Technical Support Document).

WQC-WLA SPREADSHEET OUTPUT – 0.02 MGD

Facility Name: Endless Caverns STP
Permit No.: VA00071846
Receiving Stream: Smith Creek
Date: 7/21/2016

POST - DISCHARGE WATER QUALITY CRITERIA
0.020 MGD Discharge Flow - Mix per "Mixer"

Toxic Parameter and Form	Carcinogen?	Aquatic Protection Acute	Aquatic Protection Chronic	Human Health Public Water Supplies	Human Health Other Surface Waters
Ammonia-N (Annual)	N	5.8E+00 mg/L	1.4E+00 mg/L	None	None
Chlorine, Total Residual	N	1.9E-02 mg/L	1.1E-02 mg/L	None	None

NON-ANTIDEGRADATION WASTE LOAD ALLOCATIONS
0.020 MGD Discharge - Mix per "Mixer"

Aquatic Protection Acute	Aquatic Protection Chronic	Human Health
1.1E+03 mg/L	3.2E+02 mg/L	N/A
3.5E+00 mg/L	2.2E+00 mg/L	N/A

WQC-WLA SPREADSHEET INPUT – 0.03 MGD

WATER QUALITY CRITERIA / WASTE LOAD ALLOCATION ANALYSIS

Facility Name: Endless Caverns STP
Receiving Stream: Smith Creek
Permit No.: VA00071846
Date: 7/21/2016
Version: OWP Guidance Memo 00-2011 (8/24/00)

Stream Information		Stream Flows		Mixing Information			Effluent Information	
Mean Hardness (as CaCO3) =	230 mg/L	1Q10 (Annual) =	3.64 MGD	Annual	- 1Q10 Flow =	100 %	Mean Hardness (as CaCO3) =	150 mg/L
90% Temperature (Annual) =	18.9 deg C	7Q10 (Annual) =	3.98 MGD		- 7Q10 Flow =	100 %	90% Temp (Annual) =	25 deg C
90% Temperature (Wet season) =	14.8 deg C	30Q10 (Annual) =	4.65 MGD		- 30Q10 Flow =	100 %	90% Temp (Wet season) =	15 deg C
90% Maximum pH =	8.2 SU	1Q10 (Wet season) =	7.3 MGD	Wet Season	- 1Q10 Flow =	%	90% Maximum pH =	7.5 SU
10% Maximum pH =	7.6 SU	30Q10 (Wet season) =	9.96 MGD		- 30Q10 Flow =	%	10% Maximum pH =	7.0 SU
Tier Designation =	1	30Q5 =	5.65 MGD				Current Discharge Flow =	0.00000 MGD
Public Water Supply (PWS) Y/N? =	Y	Harmonic Mean =	16.8 MGD				Discharge Flow for Limit Analysis =	0.03 MGD
V(alley) or P(iedmont)? =	V							
Trout Present Y/N? =	N							
Early Life Stages Present Y/N? =	Y							

Footnotes:

1. All concentrations expressed as micrograms/liter (ug/l), unless noted otherwise.
2. All flow values are expressed as Million Gallons per Day (MGD).
3. Discharge volumes are highest monthly average or 2C maximum for Industries and design flows for Municipals.
4. Hardness expressed as mg/l CaCO3. Standards calculated using Hardness values in the range of 25-400 mg/l CaCO3.
5. "Public Water Supply" protects for fish & water consumption. "Other Surface Waters" protects for fish consumption only.
6. Carcinogen "Y" indicates carcinogenic parameter.
7. Ammonia WQSs selected from separate tables, based on pH and temperature.
8. Metals measured as Dissolved, unless specified otherwise.
9. WLA = Waste Load Allocation (based on standards).
10. WLA = Waste Load Allocation (based on standards).
11. WLAs are based on mass balances (less background, if data exist).
12. Acute - 1 hour avg. concentration not to be exceeded more than 1/3 years.
13. Chronic - 4 day avg. concentration (30 day avg. for Ammonia) not to be exceeded more than 1/3 years.
14. Mass balances employ 1Q10 for Acute, 30Q10 for Chronic Ammonia, 7Q10 for Other Chronic, 30Q5 for Non-carcinogens, and Harmonic Mean for Carcinogens. Actual flows employed are a function of the mixing analysis and may be less than the actual flows.
15. Effluent Limitations are calculated elsewhere using the minimum WLA and EPA's statistical approach (Technical Support Document).

WQC-WLA SPREADSHEET OUTPUT – 0.03 MGD

Facility Name: Endless Caverns STP
Permit No.: VA00071846
Receiving Stream: Smith Creek
Date: 7/21/2016

POST - DISCHARGE WATER QUALITY CRITERIA
0.030 MGD Discharge Flow - Mix per "Mixer"

NON-ANTIDEGRADATION WASTE LOAD ALLOCATIONS
0.030 MGD Discharge - Mix per "Mixer"

Toxic Parameter and Form	Carcinogen?	Aquatic Protection Acute	Aquatic Protection Chronic	Human Health Public Water Supplies	Human Health Other Surface Waters	Aquatic Protection Acute	Aquatic Protection Chronic	Human Health
Ammonia-N (Annual)	N	5.9E+00 mg/L	1.4E+00 mg/L	None	None	7.2E+02 mg/L	2.1E+02 mg/L	N/A
Chlorine, Total Residual	N	1.9E-02 mg/L	1.1E-02 mg/L	None	None	2.3E+00 mg/L	1.5E+00 mg/L	N/A

WQC-WLA SPREADSHEET INPUT – 0.039 MGD

WATER QUALITY CRITERIA / WASTE LOAD ALLOCATION ANALYSIS

Facility Name: Endless Caverns STP
Receiving Stream: Smith Creek
Permit No.: VA00071846
Date: 7/21/2016
Version: OWP Guidance Memo 00-2011 (8/24/00)

Stream Information		Stream Flows		Mixing Information			Effluent Information	
Mean Hardness (as CaCO3) =	230 mg/L	1Q10 (Annual) =	3.64 MGD	Annual	- 1Q10 Flow =	100 %	Mean Hardness (as CaCO3) =	150 mg/L
90% Temperature (Annual) =	18.9 deg C	7Q10 (Annual) =	3.98 MGD		- 7Q10 Flow =	100 %	90% Temp (Annual) =	25 deg C
90% Temperature (Wet season) =	14.8 deg C	30Q10 (Annual) =	4.65 MGD		- 30Q10 Flow =	100 %	90% Temp (Wet season) =	15 deg C
90% Maximum pH =	8.2 SU	1Q10 (Wet season) =	7.3 MGD	Wet Season	- 1Q10 Flow =	%	90% Maximum pH =	7.5 SU
10% Maximum pH =	7.6 SU	30Q10 (Wet season) =	9.96 MGD		- 30Q10 Flow =	%	10% Maximum pH =	7.0 SU
Tier Designation =	1	30Q5 =	5.65 MGD				Current Discharge Flow =	0.00000 MGD
Public Water Supply (PWS) Y/N? =	Y	Harmonic Mean =	16.8 MGD				Discharge Flow for Limit Analysis =	0.039 MGD
V(alley) or P(iedmont)? =	V							
Trout Present Y/N? =	N							
Early Life Stages Present Y/N? =	Y							

Footnotes:

1. All concentrations expressed as micrograms/liter (ug/l), unless noted otherwise.
2. All flow values are expressed as Million Gallons per Day (MGD).
3. Discharge volumes are highest monthly average or 2C maximum for Industries and design flows for Municipals.
4. Hardness expressed as mg/l CaCO3. Standards calculated using Hardness values in the range of 25-400 mg/l CaCO3.
5. "Public Water Supply" protects for fish & water consumption. "Other Surface Waters" protects for fish consumption only.
6. Carcinogen "Y" indicates carcinogenic parameter.
7. Ammonia WQSs selected from separate tables, based on pH and temperature.
8. Metals measured as Dissolved, unless specified otherwise.
9. WLA = Waste Load Allocation (based on standards).
10. WLA = Waste Load Allocation (based on standards).
11. WLAs are based on mass balances (less background, if data exist).
12. Acute - 1 hour avg. concentration not to be exceeded more than 1/3 years.
13. Chronic - 4 day avg. concentration (30 day avg. for Ammonia) not to be exceeded more than 1/3 years.
14. Mass balances employ 1Q10 for Acute, 30Q10 for Chronic Ammonia, 7Q10 for Other Chronic, 30Q5 for Non-carcinogens, and Harmonic Mean for Carcinogens. Actual flows employed are a function of the mixing analysis and may be less than the actual flows.
15. Effluent Limitations are calculated elsewhere using the minimum WLA and EPA's statistical approach (Technical Support Document).

WQC-WLA SPREADSHEET OUTPUT – 0.039 MGD

Facility Name: Endless Caverns STP
Permit No.: VA00071846
Receiving Stream: Smith Creek
Date: 7/21/2016

POST - DISCHARGE WATER QUALITY CRITERIA
0.039 MGD Discharge Flow - Mix per "Mixer"

NON-ANTIDEGRADATION WASTE LOAD ALLOCATIONS
0.039 MGD Discharge - Mix per "Mixer"

Toxic Parameter and Form	Carcinogen?	Aquatic Protection Acute	Aquatic Protection Chronic	Human Health Public Water Supplies	Human Health Other Surface Waters	Aquatic Protection Acute	Aquatic Protection Chronic	Human Health
Ammonia-N (Annual)	N	5.9E+00 mg/L	1.4E+00 mg/L	None	None	5.6E+02 mg/L	1.7E+02 mg/L	N/A
Chlorine, Total Residual	N	1.9E-02 mg/L	1.1E-02 mg/L	None	None	1.8E+00 mg/L	1.1E+00 mg/L	N/A

PROTOCOL FOR THE EVALUATION OF THE EFFLUENT – TOXIC POLLUTANTS

Toxic pollutants were evaluated in accordance with OWP Guidance Memo No. 00-2011. According to this guidance, STPs with a design flow ≤ 0.040 MGD are treated as if there are no toxic pollutants in their discharge unless there is actual evidence to indicate otherwise. This applies to all toxic pollutants with the exception of Ammonia and Total Residual Chlorine, which are evaluated in every STP discharge. Also, these smaller STPs are not required to monitor for any toxic pollutants unless there is reason to believe that such pollutants may be present.

Acute and Chronic WLAs (WLA_a and WLA_c) were analyzed according to the protocol below using a statistical approach (STAT.exe) to determine the necessity and magnitude of limits. Human Health WLAs (WLA_{hh}) were analyzed according to the same protocol through a simple comparison with the effluent data. If the WLA_{hh} exceeded the effluent datum or data mean, no limits were required. If the effluent datum or data mean exceeded the WLA_{hh}, the WLA_{hh} was imposed as the limit.

Since there are no data available for any toxic pollutants immediately upstream of this discharge, all upstream background pollutant concentrations are assumed to be "0".

The steps used in evaluating available effluent data from STPs with design flows ≤ 0.040 MGD are as follows:

A. If all data are reported as "below detection" or < the required Quantification Level (QL) (or, for metals, in a form other than "dissolved"), then the data are not suitable for analysis and no further monitoring is required.

B. If any data value is reported as detectable at or above the required QL, then the data are adequate to determine whether effluent limits are needed.

   B.1. If the evaluation indicates that no limits are needed, then no further monitoring is required.

   B.2. If the evaluation indicates that limits are needed, then the limits and associated requirements are specified in the draft permit.

Parameter	CASRN	QL	Data	Source of Data	Data Eval
Ammonia-N (mg/L)	766-41-7	0.2 mg/L	**Default = 9 mg/L**	**a**	**B.1**
TRC (mg/L)	7782-50-5	0.1 mg/L	**Default = 20 mg/L**	**a**	**B.2**

CASRN = Chemical Abstract Service Registry Number for each parameter is referenced in the current Water Quality Standards. A unique numeric identifier designating only one substance. The Chemical Abstract Service is a division of the American Chemical Society.

"Source of Data" codes:
a = default effluent concentration

"Data Evaluation" codes:
See section titled PROTOCOL FOR THE EVALUATION OF EFFLUENT TOXIC POLLUTANTS for an explanation of the code used.

STAT.EXE RESULTS

Ammonia-N (Annual)
WLAa = 560
WLAc = 170
Q.L. = .2
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 1
Expected Value = 9
Variance = 29.16
C.V. = 0.6
97th percentile daily values = 21.9007
97th percentile 4 day average = 14.9741
97th percentile 30 day average= 10.8544
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are: 9

Total Residual Chlorine 0.010 MGD
Chronic averaging period = 4
WLAa = 4
WLAc = 4
Q.L. = 0.1
# samples/mo. = 30
# samples/wk. = 7

Summary of Statistics:

observations = 1
Expected Value = 20
Variance = 144
C.V. = 0.6
97th percentile daily values = 48.6683
97th percentile 4 day average = 33.2758
97th percentile 30 day average= 24.1210
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

A limit is needed based on Acute Toxicity
Maximum Daily Limit = 4
Average Weekly Limit = 2.44282882700811
Average Monthly Limit = 1.98248465547072

The data are: 20

Total Residual Chlorine 0.020 MGD
Chronic averaging period = 4
WLAa = 3.5
WLAc = 2.2
Q.L. = 0.1
# samples/mo. = 30
# samples/wk. = 7

Summary of Statistics:

observations = 1
Expected Value = 20
Variance = 144
C.V. = 0.6
97th percentile daily values = 48.6683
97th percentile 4 day average = 33.2758
97th percentile 30 day average= 24.1210
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

A limit is needed based on Chronic Toxicity
Maximum Daily Limit = 3.21766452491711
Average Weekly Limit = 1.96505091427722
Average Monthly Limit = 1.59474263677516

The data are: 20

Total Residual Chlorine 0.030 MGD
Chronic averaging period = 4
WLAa = 2.3
WLAc = 1.5
Q.L. = 0.1
# samples/mo. = 30
# samples/wk. = 7

Summary of Statistics:

observations = 1
Expected Value = 20
Variance = 144
C.V. = 0.6
97th percentile daily values = 48.6683
97th percentile 4 day average = 33.2758
97th percentile 30 day average= 24.1210
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

A limit is needed based on Chronic Toxicity
Maximum Daily Limit = 2.19386217607985
Average Weekly Limit = 1.33980744155265
Average Monthly Limit = 1.08732452507397

The data are: 20

Total Residual Chlorine 0.039 MGD
Chronic averaging period = 4
WLAa = 1.8
WLAc = 1.1
Q.L. = 0.1
# samples/mo. = 30
# samples/wk. = 7

Summary of Statistics:

observations = 1
Expected Value = 20
Variance = 144
C.V. = 0.6
97th percentile daily values = 48.6683
97th percentile 4 day average = 33.2758
97th percentile 30 day average= 24.1210
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

A limit is needed based on Chronic Toxicity
Maximum Daily Limit = 1.60883226245855
Average Weekly Limit = 0.98252545713861
Average Monthly Limit = 0.79737131838758

The data are: 20

APPENDIX C

BASES FOR PERMIT SPECIAL CONDITIONS

Tabulated below are the sections of the permit, with any changes and the reasons for the changes identified. Also provided is the basis for each of the permit special conditions.

Cover Page	Content and format as prescribed by the Guidance Memo No. 14-2003.
Part I.A.1	**Effluent Limitations and Monitoring Requirements - 0.010 MGD Flow Tier:** Bases for effluent limits are provided in previous pages of this fact sheet. Monitoring requirements are as prescribed by Guidance Memo No. 14-2003 *Updates Part I.A.1 of the previous permit with the following:* • Annual monitoring and associated footnote for TKN, Nitrite-N + Nitrate-N, and TN were added per Guidance Memo No. 14-2011
Part I.A.2	**Effluent Limitations and Monitoring Requirements - 0.020 MGD Flow Tier:** Bases for effluent limits are provided in previous pages of this fact sheet. Monitoring requirements are as prescribed by Guidance Memo No. 14-2003 *Updates Part I.A.2 of the previous permit with the following:* • Annual monitoring and associated footnote for TKN, Nitrite-N + Nitrate-N, and TN were added per Guidance Memo No. 14-2011
Part I.A.3	**Effluent Limitations and Monitoring Requirements - 0.03 MGD Flow Tier:** Bases for effluent limits are provided in previous pages of this fact sheet. Monitoring requirements are as prescribed by Guidance Memo No. 14-2003 *Updates Part I.A.3 of the previous permit with the following:* • Annual monitoring and associated footnote for TKN, Nitrite-N + Nitrate-N, and TN were added per Guidance Memo No. 14-2011
Part I.A.4	**Effluent Limitations and Monitoring Requirements - 0.039 MGD Flow Tier:** Bases for effluent limits are provided in previous pages of this fact sheet. Monitoring requirements are as prescribed by Guidance Memo No. 14-2003 *Updates Part I.A.4 of the previous permit with the following:* • Annual monitoring and associated footnote for TKN, Nitrite-N + Nitrate-N, and TN were added per Guidance Memo No. 14-2011
Part I.B	**TRC Limitations and Monitoring Requirements:** *Updates Part I.B of the previous permit with minor wording changes. Also, less stringent limits were included for the 0.020 MGD and 0.030 MGD flow tiers.* Required by Sewage Collection and Treatment (SCAT) Regulations, 9VAC25-790 and Water Quality Standards, 9VAC25-260-170, Bacteria; other waters. Also, 40 CFR 122.41(e) requires the permittee, at all times, to properly operate and maintain all facilities and systems of treatment in order to comply with the permit. This ensures proper operation of chlorination equipment to maintain adequate disinfection.
Part I.C	**Effluent Limitations and Monitoring Requirements – Additional Instructions:** *Updates Part I.C of the previous permit with minor wording changes. Also, the QL for BOD_5 was changed from 5 mg/L to 2 mg/ and a QL for TKN was included.* Authorized by VPDES Permit Regulation 9 VAC25-31-190 J.4 and 220.I. This condition is necessary when pollutants are monitored by the permittee and a maximum level of quantification and/or a specific analytical method is required in order to assess compliance with a permit limit or to compare effluent quality with a numeric criterion. Nutrient reporting language was also added.

Part I.D.1	**95% Capacity Reopener:** *Updates Part I.D.1 of the previous permit with minor wording changes*. Required by VPDES Permit Regulation 9VAC25-31-200 B 4 for Publicly Owned Treatment Works (POTW) and Privately Owned Treatment Works (PVOTW) permits.
Part I.D.2	**Materials Handling/Storage:** *Updates Part I.D.2 of the previous permit with minor wording changes*. 9VAC25-31-50.A prohibits the discharge of any waste into State waters unless authorized by permit. Code of Virginia §62.1-44.16 and §62.1-44.17 authorizes the Board to regulate the discharge of industrial waste or other waste.
Part I.D.3	**O&M Manual Requirement:** *Updates Part I.D.3 of the previous permit with changes to what is required to be included in the O&M Manual.* Required by Code of Virginia Section 62.1-44.19, Sewage Collection and Treatment (SCAT) Regulations 9VAC25-790, and VPDES Permit Regulation 9VAC25-31-190.E for all STPs.
Part I.D.4	**CTC/CTO Requirement:** *Identical to Part I.D.4 of the previous permit.* Required by Code of Virginia 62.1-44.19, Sewage Collection and Treatment (SCAT) Regulations 9VAC25-790, and VPDES Permit Regulation 9VAC25-31-190.E for all STPs.
Part I.D.5	**SMP Requirement:** *Updates Part I.D.5 of the previous permit with the requirement to submit a SMP for approval 30 days prior to commencement of discharge.* VPDES Permit Regulation 9VAC25-31-100.Q, 220.B.2, and 420 through 720, and 40 CFR Part 503 require all treatment works treating domestic sewage to submit information on their sludge use and disposal practices and to meet specified standards for sludge use and disposal. Technical requirements are derived from the Virginia Pollution Abatement Permit Regulation (9VAC25-32-10 *et seq.*)
Part I.D.6	**Reliability Class:** *Identical to Part I.D.6 of the previous permit.* Required by Sewage Collection and Treatment (SCAT) Regulations 9VAC25-790 for all municipal facilities.
Part I.D.7	**Treatment Works Closure Plan:** *Updates Part I.D.7 of the previous permit with minor wording changes*. This condition establishes the requirement to submit a closure plan for the treatment works if the treatment facility is being replaced or is expected to close. This is necessary to ensure industrial sites and treatment works are properly closed so that the risk of untreated waste water discharge, spills, leaks and exposure to raw materials is eliminated and water quality maintained. Section 62.1-44.21 requires every owner to furnish when requested plans, specification, and other pertinent information as may be necessary to determine the effect of the wastes from his discharge on the quality of state waters, or such other information as may be necessary to accomplish the purposes of the State Water Control Law.
Part I.D.8	**Reopeners:** a. *Identical to Part I.D.8.a of the previous permit:* Section 303(d) of the Clean Water Act requires that total maximum daily loads (TMDLs) be developed for streams listed as impaired. This special condition is to allow the permit to be reopened if necessary to bring it into compliance with any applicable TMDL approved for the receiving stream. The reopener recognizes that, according to section 402(o)(1) of the Clean Water Act, limits and/or conditions may be either more or less stringent than those contained in this permit. Specifically, they can be relaxed if they are the result of a TMDL, basin plan, or other wasteload allocation prepared under section 303 of the Act. b. *Updates Part I.D.8.b of the previous permit with minor wording changes:* 9VAC25-40-70.A authorizes DEQ to include technology-based annual concentration limits in the permits of facilities that have installed nutrient control equipment, whether by new construction, expansion or upgrade. c. *Identical to Part I.D.8.c of the previous permit:* 9VAC25-31-390.A authorizes DEQ to modify VPDES permits to promulgate amended water quality standards.

Part II	**Conditions Applicable to All VPDES Permits:** *Updates Part II of the previous permit.* VPDES Permit Regulation 9VAC25-31-190 requires all VPDES permits to contain or specifically cite the conditions listed.